

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (original): A redundant clock module comprising:
at least two oscillators, a primary oscillator providing an output to the module and at least one secondary redundant oscillator to take over for the primary oscillator in case of a failure or out of tolerance condition;

monitoring circuitry for monitoring the outputs of the at least two oscillators, wherein the monitoring circuitry includes a control loop with a VCO and means for analog voltage monitoring of the VCO voltage to determine if the oscillators are operating;

detection circuitry for detecting a failure or an out of tolerance condition of the oscillators; and

switching circuitry for seamlessly switching from a failed or out of tolerance oscillator to an operating and in tolerance oscillator.

2. (original): The redundant clock module of claim 1 wherein monitoring and detection circuitry is provided for each oscillator.

3. (original): The redundant clock module of claim 1 wherein the oscillators are monitored by comparing the oscillator output frequency to the VCO frequency.

4. (currently amended): ~~The redundant clock module of claim 1~~ A redundant clock module comprising:

at least two oscillators, a primary oscillator providing an output to the module and at least one secondary redundant oscillator to take over for the primary oscillator in case of a failure or out of tolerance condition;

monitoring circuitry for monitoring the outputs of the at least two oscillators, wherein the monitoring circuitry includes a control loop with a VCO and means for analog voltage monitoring of the VCO voltage to determine if the oscillators are operating; detection circuitry for detecting a failure or an out of tolerance condition of the oscillators; and

switching circuitry for seamlessly switching from a failed or out of tolerance oscillator to an operating and in tolerance oscillator;

wherein the monitoring circuitry includes analog voltage comparators to compare the control voltage of the VCO to a fixed reference voltage that is the equivalent of the frequency limit established by the tolerance desired and the VCO voltage versus frequency characteristic.

5. (original): The redundant clock module of claim 1 wherein the detection circuitry generates an error signal that indicates that an oscillator has failed or is out of tolerance.

6. (currently amended): The redundant clock module of claim 1 A redundant clock module comprising:

at least two oscillators, a primary oscillator providing an output to the module and at least one secondary redundant oscillator to take over for the primary oscillator in case of a failure or out of tolerance condition;

monitoring circuitry for monitoring the outputs of the at least two oscillators, wherein the

monitoring circuitry includes a control loop with a VCO and means for analog voltage

monitoring of the VCO voltage to determine if the oscillators are operating;

detection circuitry for detecting a failure or an out of tolerance condition of the
oscillators; and

switching circuitry for seamlessly switching from a failed or out of tolerance oscillator to
an operating and in tolerance oscillator;

wherein the switching circuitry receives error signals from the detection circuitry for
detecting a failed or out of tolerance oscillator.

7. (currently amended): ~~The redundant clock module of claim 6~~ A redundant clock
module comprising:

at least two oscillators, a primary oscillator providing an output to the module and at least
one secondary redundant oscillator to take over for the primary oscillator in case of a failure or
out of tolerance condition;

monitoring circuitry for monitoring the outputs of the at least two oscillators, wherein the
monitoring circuitry includes a control loop with a VCO and means for analog voltage
monitoring of the VCO voltage to determine if the oscillators are operating;

detection circuitry for detecting a failure or an out of tolerance condition of the
oscillators; and

switching circuitry for seamlessly switching from a failed or out of tolerance oscillator to
an operating and in tolerance oscillator;

wherein the switching circuitry removes power from the failed oscillator and switches the
output to a working oscillator.

8. (currently amended): ~~The redundant clock module of claim 1 further comprising A redundant clock module comprising:~~

at least two oscillators, a primary oscillator providing an output to the module and at least one secondary redundant oscillator to take over for the primary oscillator in case of a failure or out of tolerance condition;

monitoring circuitry for monitoring the outputs of the at least two oscillators, wherein the monitoring circuitry includes a control loop with a VCO and means for analog voltage monitoring of the VCO voltage to determine if the oscillators are operating;

detection circuitry for detecting a failure or an out of tolerance condition of the oscillators;

switching circuitry for seamlessly switching from a failed or out of tolerance oscillator to an operating and in tolerance oscillator; and

control circuitry with a control loop and a VCO having a slower response time than the detection circuitry control loop so that it does not change frequency quickly during switching from one oscillator to another.

9. (original): The redundant clock module of claim 1 further comprising fault indication means for visually determining which oscillators has failed and needs to be replaced.

10. (original): A redundant clock module comprising:

at least two reference oscillators;

at least two monitoring circuits for monitoring the outputs of at least two reference oscillators;

a detection circuit for detecting a failure or out of tolerance condition of the oscillators;
and

wherein the monitoring and detection circuits include analog voltage comparators to compare a control voltage of a VCO to a fixed reference voltage that is the equivalent of the frequency limit established by the tolerance desired and the VCO voltage versus frequency characteristic.

11. (original): A redundant clock module comprising:
 - a reference oscillator input stage;
 - at least two frequency detect stages for monitoring outputs of at least two reference oscillators in the reference oscillator input stage, wherein the frequency detect stages include a phase-frequency detector, a control loop with a VCO, and a VCO control voltage for monitoring the outputs of the oscillators;
 - a frequency detect logic stage, wherein the frequency detect logic stage includes at least two analog voltage comparators to compare the control voltage of the VCO to a fixed reference voltage that is the equivalent of the frequency limit established by the tolerance desired and the VCO voltage versus frequency characteristic;
 - a power, startup, reset stage;
 - an oscillator select logic stage; and
 - an output control loop path stage, wherein the output control loop path stage includes a phase-frequency detector, a control loop with a VCO for allowing the output frequency of the VCO to change slowly in the event that a reference oscillator fails and outputting an reference oscillator output.